Catheter occlusion technique to facilitate distal anastomoses using vein grafts

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Several different modes of achieving a bloodless operating field by proximal and distal occlusion of blood vessels have been described. Vascular clamps, vessel loops, intraluminal occluding devices, and Tourniquets have been used to control the tibial and pedal vessels but may cause injury or fail to control heavily calcified arteries. We describe an alternative way to control proximal and distal small arteries by using small, umbilical vein, feeding catheters. The catheters are introduced in the proximal and distal arterial lumen and in the vein graft lumen, achieving hemostasis, technically facilitating the suturing, and providing a means for the administration of vasodilator or thrombolytic agents as well as for a completion angiography. (J Vasc Surg 2005;42:173-5.)

A bloodless operating field is a sine qua non for the performance of a successful distal anastomosis. Several different methods to control proximal and distal blood flow have been described, including classic clamping, looping, limb (tourniquet) bandaging, and intraluminal occlusive devices. Various studies have shown the injurious consequences of the vascular clamping.[1-10] In small arteries, vascular clamping has been shown to result in endothelial cell denudation and damage to the smooth muscle cells of the media.

With our technique, we aimed to achieve adequate control of blood flow while at the same time we used the small-caliber catheters to facilitate the technique of forming the anastomosis. During the procedure, the catheters can provide a conduit for the delivery of drugs and thrombolytic agents. At the end of the procedure, a completion angiogram can be performed through the same catheters.

TECHNIQUE

The method mainly applies to a vein graft distal bypass, although the same catheters can also be used for a synthetic graft-distal anastomosis. After the relevant vein and distal artery dissection and preparation, a small pediatric feeding umbilical catheter is introduced into the proximal end of the host vessel (Fig 1).

The second catheter is introduced via a small tributary and passed along the vein graft and into the distal end of the host artery (Figs 2 and 3).

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In the event that no distal side branches are available for the catheter insertion, three modifications of the original technique can be used:

1. A more proximal side branch can be used, as the catheter is long enough (500 mm) to reach the desired level;
2. Pass the catheter directly into the distal artery, without it passing through the graft, and
3. Make a venotomy and pass the catheter through it.

This provides the necessary hemostasis and access for the delivery of drugs and irrigating fluids. The operating field is then clear of any clutter, and a parachute technique anastomosis can be easily performed. The latter is greatly facilitated as the catheters are present in the important areas, such as the corners of the arteriotomy.

When the anastomosis is completed, the first catheter can be withdrawn and the second pulled back into the vein graft (Fig 4).

This then facilitates an easy completion angiography and examination of the technical correctness of the anastomosis.

Finally, the catheter is removed, and the vein tributary is ligated.

DISCUSSION

Control of the delicate, diseased crural vessels has always been a problem because of their size and fragility. Several studies have shown the deleterious effects to the arterial lumen of clamping, and various methods of alternative clamping have been suggested. Among them are modified vascular clamps, intra-arterial occluding balloons, tourniquet bandaging, and elastic vessel loops.

The use of a soft, pediatric umbilical feeding catheter not only provides adequate hemostasis but also facilitates the anastomosis procedure by holding the two constituents (artery and vein) in rather steady positions. At the same time, the catheters protect the difficult areas ("heel" and

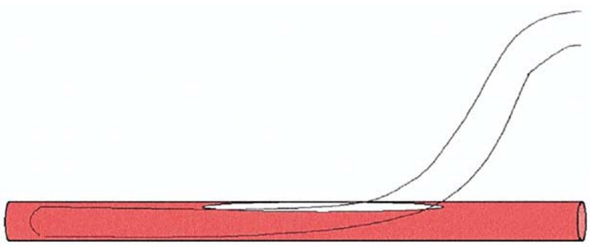

Fig 1. Arteriotomy and insertion of the proximal catheter.

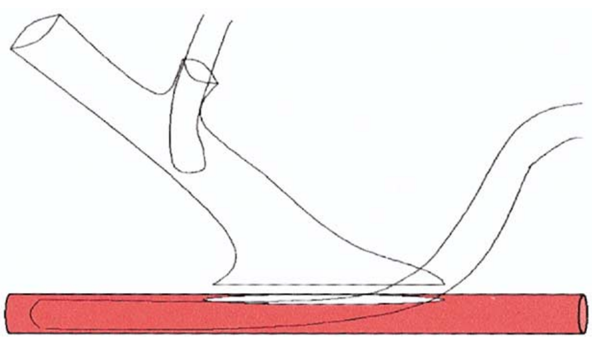

Fig 2. Distal end of the vein graft and insertion of the second catheter through a tributary.

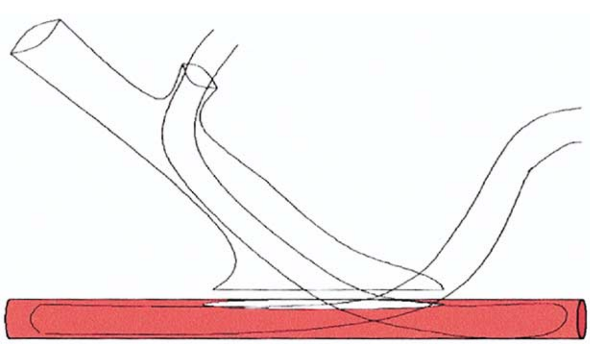

Fig 3. Catheters in place and formation of the anastomosis.

"toe") of the anastomosis from technical pitfalls by widely exposing the arteriotomy. Because gentle manipulation of the catheter is sufficient for the exposure of the arterial and vein walls, the use of forceps is unnecessary.

The catheters offer further clinical advantages over the clamps. The continuous or intermittent infusion of low-dose heparinized saline through the distal lumen may prevent distal thrombus formation. Also, vasodilating or thrombolytic agents can be administered when necessary.

The presence of the last catheter in the harvested vein (Fig 4) facilitates easy completion angiography and examination of the technical correctness of the distal anastomosis.

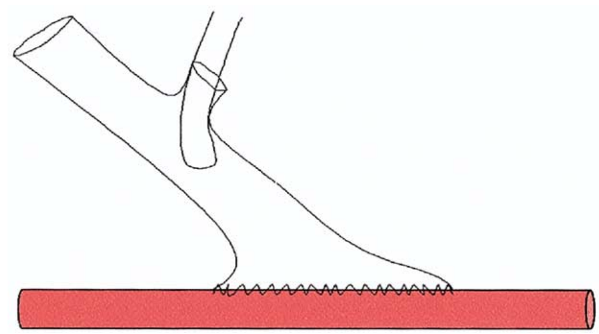

Fig 4. Anastomosis completed, proximal catheter removed and the withdrawn distal catheter can be used as a conduit for a completion angiography.

For prosthetic grafts, one can also pass the catheter directly into the distal artery without it passing through the graft.

We used this technique in 10 cases in the 5-month period between July 2004 and December 2004, representing 33% of the total distal infrainguinal bypasses performed for the year 2004. It is now our method of choice, and we have not used another way of achieving a clear operating field since we started using it.

The operating field has been always clean and bloodless with this technique, and we have used no other adjunctive measures to achieve this. It is important, though, to choose the right sized catheter and adjust it for each patient.

This technique has worked very effectively, even with heavily calcified vessels, provided that a patent lumen was present for the advancement of the catheter.

One of the potential problems is a stenosis in the inflow side of the target artery just proximal to the arteriotomy.

We initially use the medium-size 6F catheter. If that cannot pass through, we use the 4F size and have only had one failure. It worked very well in nine of the 10 patients, and it works best when the arteries are not heavily calcified. There are some difficulties when (1) there are no distal vein side branches and the vein is small, and (2) the catheter cannot be coaxed into a proper position because of heavy calcifications, as occurred in one of the 10 patients.

The technique cannot be used when the catheter cannot be advanced smoothly in the artery. We have been able to catheterize very narrow (<1 mm) calcified vessels with the 4F size catheter in three of the 10 patients in whom we used the described technique.

The catheter comes in different sizes and can be adapted to your patient. Diameters available are 4F, 6F, and 8F. The length is a standard 500 mm for all sizes. The catheters we used were from Smith Industries Medical Systems, PORTEX Limited, Hythe, Kent, CT21 6JL, United Kingdom. The cost of each catheter is £1.17 ($2.25) in the UK.

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